

VERSION WITH MARKINGS TO SHOW CHANGES MADE:

THE SPECIFICATION:

rd Paragraph [0014] as follows:

4] -- FIG. 3 is a winding diagram of a strand of a two-layer  
ing with the slot number  $N = 9$  slots; and--.

rd Paragraph [0015] as follows:

5] -- FIG. 4 is a fragmentary section view of a stator of the  
hronous motor according to the present invention; and

FIG. 5 is a schematic perspective diagram of a motor having  
or and a stator with a slot skew  $\gamma$ --.

the following paragraph after [0026] and before [0027]:

FIG. 5 is a schematic perspective view of a motor with a stator 42 and a rotor  
The rotor 41 includes permanent magnets 40 which are arranged on the  
circumference of the rotor. The angle  $\gamma$  (reference numeral 50) subtended  
ie periphery of the stator in the axial direction between the longitudinal axis  
a stator and the longitudinal direction of the stator slots is referred to as "slot  
" --.

**THE CLAIMS:**

and the following claim:

(Amended) The synchronous motor of claim 1, wherein the stator includes a laminated core with a plurality of slots, each slot defining a slot gap and a slot width, wherein a width of the slot skew of gap is at least half of the a slot pitch width.

## REMARKS

The last Office Action of November 2, 2001 has been carefully considered. Consideration of the instant application in view of the foregoing amendments the following remarks is respectfully requested.

Claims 1 to 6 are pending in the application.

It is noted that the drawings are objected to because of applicant's failure to show every feature set forth in the claims.

Claims 1-3 and 5 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese Pat. No. JP 62-185545 (hereinafter "Koichi") in view of S. Pat. No. 3,673,477 (hereinafter "Broadway et al.").

Claims 4 and 6 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Koichi in view of Broadway et al. and further in view of U.S. No. 5,030,864 (hereinafter "Van Hout et al.").

## OBJECTION TO THE DRAWING

The objection to the drawings under 37 CFR 1.83(a) has been noted. However, it is applicant's contention that the submission of a drawing to illustrate rotor configuration recited in claims 5 and 6 is not necessary for an understanding of the invention. (35 U.S.C. §113 states that "applicant shall show a drawing where necessary for the understanding of the subject matter sought to be patented."). For example, a rotor with an outer circumference and

iding permanent magnets which are arranged on the outer circumference of rotor (claim 5) is shown in Fig. 1 of JP 62-185545 cited by the examiner. Likewise, permanent magnets which are arranged interiorly of the rotor, are cited, for example, in FIG. 2 of U.S. Patent 5,030,864 cited by the examiner, in FIG. 2 of U.S. Patent 5,091,668. Accordingly, those skilled in the relevant art will be able to recognize the features recited in claims 5 and 6 without the aid of a drawing.

Applicant also submits that the term "slot skew" recited in claim 1 is known in the art and denotes the angle subtended on the periphery of the stator in the radial direction between the longitudinal axis of the stator and the longitudinal direction of the stator slots. To clarify the meaning, applicant has included a new FIG. 5 which shows the definition of the skew angle  $\gamma$ . The new FIG. 5 is merely added to define terminology used in the relevant art and does not introduce new matter. FIG. 5 also shows the rotor in a configuration known from JP 62-185545 discussed *supra*.

The specification have been amended to reflect the incorporation of new claim 5.

Applicant respectfully requests that the examiner withdraw the objections to the drawings under 37 CFR 1.83(a).

## REJECTION UNDER 35 U.S.C. §103(a)

The rejection of claims 1-3 and 5 under 35 U.S.C. §103(a) as being unpatentable over Koichi in view of Broadway et al. is hereby traversed and reconsideration thereof is respectfully requested in view of remarks set forth below.

Independent claim 1 is directed to a permanent excited synchronous motor with a stator. The stator has a winding, which includes cyclically repeating pairs  $|\xi_p| = 0.945$ ,  $|\xi_{sp}| = 0.140$ , and  $|\xi_{tp}| = 0.060$ , and a skew angle  $\gamma = \frac{2\pi}{18p}$ , wherein  $p$  is the number of pole pairs. Claims 2-6 depend from claim 1.

Koichi discloses a 4-pole permanent magnet rotary electric machine with a core 1, permanent magnets 21-24, an armature core 3, an armature winding 4, and teeth 51-59. The stator has  $NS = 9$  slots. None of the Figs. 1-5 of Koichi teaches the specific arrangement of the stator windings, which is shown in detail in Figs. 1 and 2 of the present invention and corresponds to the winding factors  $|\xi_p|$  recited in claim 1, nor does Koichi teach the recited skew angle. However, applicant notes that Koichi teaches a 4-pole motor.

The winding factors are optimized for optimum operating performance of the motor, taking into consideration the field distribution at the fundamental frequency as well as at the harmonic frequencies. This results in different winding factors depending on the application. The winding arrangement of the present invention is optimized for suppression of harmonic content.

The reference to Broadway et al., unlike the present invention which is directed to a permanent-magnet excited motor, describes a pole-changing excitation motor. This is an entirely different motor design, and none of the elements disclosed in the '477 patent remotely suggest the winding pattern recited in claim 1. Although Broadway refers to the "necessity to minimize the risk involved by designing production machines for minimum harmonic content" (col. 2, lines 9-10), he does not suggest a winding pattern of the type disclosed in claim 1.

With respect to claim 2, Broadway actually teaches away from using an number of slots, which according to Broadway "may not be the ideal coil count for the elimination of harmonics." (col. 2, lines 37-38). Note that Fig. 2 of the present invention discloses the use of 9 slots. Accordingly, not only do Koichi and Broadway, taken either alone or in combination, fail to disclose, teach or suggest the subject matter recited in claim 1, but those skilled in the art would have no motivation to combine Koichi and Broadway to arrive at the two-layer winding of 9 slots recited in claim 2.

Accordingly, Applicant respectfully requests that the rejection of claim 1 be withdrawn. Claims 2, 3 and 5 which depend from amended claim 1 should also be patentable over the Koichi and Broadway et al. references for the same reason that claim 1 is patentable.

Applicant also wishes to point out that a motor winding can be optimized in many ways to satisfy various criteria. For example, a winding can be optimized to provide an optimum field at the fundamental frequency, either with a minimum

ionic contribution or with a controlled harmonic field. This results in different  
ing factors and different winding patterns, which are not predictable simply  
trapolation from a winding pattern known in the art.

Claims 4 and 6 were rejected under 35 U.S.C. §103(a) as being  
tentable over Koichi in view of Broadway et al. and further in view of van  
et al.

Claim 4 has been amended to correct a typographical error. Claim 4 now  
as that the width of the slot gap (and not the "slot skew") is at least half of the  
width. This change is supported in paragraph [0022] of the specification,  
n states that "the gap 25 has a width which is at least half the width W of the  
22".

Van Hout et al. disclose a three-phase electrical machine, in particular a  
motor, which avoids skewing of the poles and instead defines a particular  
rt of the air gap in the tangential direction. However, the Van Hout et al.  
ence does not specify the winding arrangement and hence does not disclose  
act matter material for the patentability of claim 1. Since claim 4 depends  
claim 1, claim 4 should also be patentable over the Koichi, Broadway and  
Hout references, either taken alone or in combination, for the same reason  
claim 1 is patentable:

Since none of the references of record, either taken alone or in  
ination, anticipate the subject matter recited in claim 1, Applicant therefore  
ectfully requests that the Examiner reconsider and withdraw all outstanding  
itions and objections.

## CONCLUSION

Applicant believes that when the Examiner reconsiders the claims in the of the above comments, he will agree that the invention is in no way properly or anticipated or even suggested by any of the references however they are idered.

In view of the above presented remarks and amendments, it is respectfully nitted that all claims on file should be considered patentably differentiated the art and should be allowed.

Reconsideration and allowance of the present application are respectfully ested.

Should the Examiner consider necessary or desirable any formal changes /here in the specification, claims and/or drawing, then it is respectfully ested that such changes be made by Examiner's Amendment, if the niner feels this would facilitate passage of the case to issuance. If the niner feels that it might be helpful in advancing this case by calling the rsigned, applicant would greatly appreciate such a telephone interview.

Respectfully submitted,

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